

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Fufang Zha et al.
Serial No: 10/572,893
Confirmation No: 2949
Filed: March 20, 2006
For: METHOD OF CLEANING MEMBRANE MODULES
Examiner: Menon, Krishnan S.
Art Unit: 1797

CERTIFICATE OF TRANSMISSION UNDER 37 C.F.R. § 1.8(a)

The undersigned hereby certifies that this document is being electronically filed in accordance with § 1.6(a)(4), on the 26th day of April, 2010.

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Commissioner for Patents

APPEAL BRIEF UNDER 37 C.F.R. § 41.37

Dear Sir:

This Appeal Brief is filed in response to the Final Office Action mailed on December 17, 2009 and in furtherance of the Notice of Appeal filed on February 26, 2010. The fee of \$540 under 37 C.F.R. § 41.20(a)(2) accompanies this filing.

TABLE OF CONTENTS

| | | |
|-------|--|----|
| I. | Real Party in Interest (37 C.F.R. § 41.37 (c)(1)(i))..... | 3 |
| II. | Related Appeals and Interferences (37 C.F.R. § 41.37(c)(1)(ii)) | 3 |
| III. | Status of Claims (37 C.F.R. § 41.37(c)(1)(iii))..... | 3 |
| IV. | Status of Amendments (37 C.F.R. § 41.37(c)(1)(iv)) | 3 |
| V. | Summary of Claimed Subject Matter (37 C.F.R. § 41.37(c)(1)(v)) | 3 |
| VI. | Grounds of Rejections to Be Reviewed on Appeal (37 C.F.R. § 41.37(c)(1)(vi)) | 4 |
| VII. | Argument (37 C.F.R. § 41.37(c)(1)(vii)) | 5 |
| | A. Each of claims 1, 4-11, and 24-28 is patentable over the combination of Smith and/or Sunaoka and/or Kopp and/or Cote and/or JP '769..... | 5 |
| | 1. One of ordinary skill in the art would not have been motivated to have combined Smith and/or Sunaoka and/or Kopp and/or Cote and/or JP '769 in the manner asserted..... | 5 |
| | i. The asserted motivations for combining the cited references are facially invalid | 5 |
| | ii. One of ordinary skill in the art would not have been motivated to have combined Smith and/or Sunaoka and/or Kopp and/or Cote and/or JP '769 in the manner asserted | 8 |
| | 2. Even if the asserted combination of references were valid, the combination still fails to teach each and every element of the present claims. | 12 |
| | 3. Secondary indicia of non-obviousness illustrate that the claimed subject matter is non-obvious..... | 13 |
| | B. Summary | 16 |
| VIII. | Claims Appendix (37 C.F.R. § 41.37(c)(1)(viii)) | 17 |
| IX. | Evidence Appendix (37 C.F.R. § 41.37(c)(1)(ix)) | 23 |
| X. | Related Proceedings Appendix (37 C.F.R. § 41.37(c)(1)(x)) | 24 |
| XI. | Conclusion | 25 |

I. REAL PARTY IN INTEREST (37 C.F.R. § 41.37(c)(1)(i))

The real party in interest is the assignee of the instant application, namely Siemens Water Technologies Corp., a Delaware corporation with a place of business at 181 Thorn Hill Road, Warrendale, Pennsylvania 15086.

II. RELATED APPEALS AND INTERFERENCES (37 C.F.R. § 41.37(c)(1)(ii))

There are no appeals or interferences known to Appellant, Appellant's legal representative, or the assignee of the instant application that will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS (37 C.F.R. § 41.37(c)(1)(iii))

Claims 1-23 were pending in the application as filed on March 20, 2006. Claims 1, 4, 8, 9, 12, 16, 21, and 23 were amended in a Preliminary Amendment filed March 20, 2006. Claims 1 and 4-12 were amended, claims 24-29 were added, claims 13-18 were withdrawn, and claims 2, 3, and 19-23 were canceled in an Amendment filed on February 23, 2009. In an Amendment filed on May 4, 2009, claims 1, 4-6, 9, 10, 25, and 28 were amended and claims 12 and 29 were canceled. Claims 1, 4-11, and 24-28 currently stand rejected, with claims 1, 4, and 10 being in independent form. Claims 1, 4-11, and 24-28 are being appealed herein.

IV. STATUS OF AMENDMENTS (37 C.F.R. § 41.37(c)(1)(iv))

No claim amendments were presented in a Response filed on November 12, 2009. A copy of the claims as pending, incorporating all prior amendments and showing the status of each of the claims, is attached as a Claims Appendix beginning on page 12 of this Appeal Brief.

V. SUMMARY OF CLAIMED SUBJECT MATTER (37 C.F.R. § 41.37(c)(1)(v))

Aspects and examples of the claimed subject matter are generally directed to methods and apparatus for backwashing a membrane filtration system wherein only permeate remaining present in the filtration system when the filtration process is stopped or suspended is used to provide liquid for backwashing the membrane pores. In one example, a method for backwashing a membrane filtration system is disclosed. The method generally involves filtering feed though hollow fiber membranes and removing the permeate produced from lumens of the membranes

through a manifold, suspending the filtration process, scouring the outer surfaces of the hollow fiber membranes with a gas, isolating the manifold, the hollow membrane lumens, and a portion of piping by closing a valve on a portion of piping in fluid communication with the manifold, and applying a gas pressurized to a pressure below the bubble point of the hollow fiber membranes to permeate remaining in the manifold to affect a backwash of the hollow fiber membranes. The method further involves discharging backwash waste from the modules in which the hollow fiber membranes are mounted, releasing the gas pressure, and resuming filtration. (See Applicant's specification as originally filed at page 9, lines 1 -22 (paragraphs [0053] to [0058] of corresponding U.S. Patent Publication No. US2006/0261007 A1) and FIG. 1.)

In another example, a method of filtering solids from a liquid suspension is disclosed. The method generally involves applying the liquid suspension to lumens of filtration membranes, filtering the liquid suspension through pores in walls of the filtration membranes, forming liquid permeate on a shell side of a pressure vessel in which the filtration membranes are mounted, and drawing off liquid permeate from the shell side of the pressure vessel. The method further involves periodically suspending the filtration process and applying a gas at a pressure below a bubble point of the filtration membranes to liquid permeate remaining within the shell side of the pressure vessel, the liquid permeate remaining within the shell side of the pressure vessel consisting of the liquid permeate formed on the shell side of the pressure vessel, to displace at least some of the liquid permeate through the filtration membrane pores in a direction opposite to that of filtration, the gas not penetrating into the membrane pores. (See Applicant's specification as originally filed at page 3, line 20 – page 5, line 5 (paragraphs [0014] to [0026] of corresponding U.S. Patent Publication No. US2006/0261007 A1.))

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL
(37 C.F.R. § 41.37(c)(1)(vi))

Whether each of claims 1, 4-11, and 24-28 is unpatentable over the combination of U.S. Patent No. 5,403,479 to Smith et al. (hereinafter "Smith") and/or U.S. Patent No. 5,209,852 to Sunaoka et al. (hereinafter "Sunaoka") and/or U.S. Patent No. 5,643,455 to Kopp et al. (hereinafter "Kopp") and/or U.S. Patent Publication No. 2001/0052494 to Cote et al. (hereinafter "Cote") and/or JP 11076769 (hereinafter "JP '769").

VII. ARGUMENT (37 C.F.R. § 41.37(c)(1)(vii))

For the reasons provided below, the Examiner's rejections are improper and should be reversed. Each of claims 1, 4-11, and 24-28, as presented, is allowable.

A. Each of claims 1, 4-11, and 24-28 is patentable over the combination of Smith and/or Sunaoka and/or Kopp and/or Cote and/or JP '769.

1. One of ordinary skill in the art would not have been motivated to have combined Smith and/or Sunaoka and/or Kopp and/or Cote and/or JP '769 in the manner asserted,
 - i. The asserted motivations for combining the cited references are facially invalid.

Claims 1, 4-11, and 24-28 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Smith and/or Sunaoka and/or Kopp and/or Cote and/or JP '769.

None of Smith, Sunaoka, Kopp, Cote, or JP '769 disclose or suggest each and every element of any of the claims of the present application. The deficiencies of each of Smith, Sunaoka, Kopp, Cote, and JP '769 to disclose or suggest each element of independent claim 1 of the present application are set forth in paragraphs 8, 14, 18, 21, and 25 of the Declaration of Dr. Fufang Zha, dated October 30, 2009 (hereinafter the "Zha Declaration"), attached as an appendix to this Appeal Brief, and are discussed in the Response filed November 12, 2009.

There has been no suitable objective evidence provided that there exists any suggestion or motivation in any of Smith, Sunaoka, Kopp, Cote, or JP '769, to modify any of these five references in view of any other of these references or in view of the general knowledge of one of ordinary skill in the art to result in the methods claimed in the present application. The reasons presented by the Examiner for finding the asserted combinations of references cited obvious do not establish a proper motivation to combine these references. In the Office Action mailed December 17, 2009 (the "Office Action"), on page 4, the Examiner asserts that "Smith does teach that dead-end backwashing is known . . . Thus, providing the gas pressure from both ends of the membrane would be obvious to one of ordinary skill in the art." On page 5 of the Office

Action, the Examiner asserts that “using compressed air to effect pumping of liquids, and particularly, for backwashing filters and membranes is well known in the art” and that “[a]gitation of the membrane by scouring gas is taught by Cote, and is well known in the art.” On page 6 of the Office Action, the Examiner asserts that “[i]t would be obvious to one of ordinary skill in the art to use the teachings of Kopp and/or Smith in the teaching of Cote to improve the cleaning process of Cote, particularly, by removing the permeate in the lumen by gas pressure below the bubble point, as suggested by Kopp or Smith.” On pages 6-7 of the Office Action, the Examiner asserts that “one would use the teachings of Smith for the backwashing steps in the teaching of Sunaoka because it is highly effective according to Smith.” The Examiner asserts on page 7 of the Office Action that the method of claim 10 is obvious simply because “it is well known that hollow fibers can be used for both ‘outside-in’ and ‘inside-out’ operation.” Further, on page 9 of the Office Action, the Examiner asserts that “Combination of such well known elements [such as disclosed individually in Smith, Sunaoka, Kopp, Cote, or JP ’769] is within the skill and commonsense of one of ordinary skill in the art.”

These assertions do not reflect a proper standard for establishing a motivation to combine the elements asserted to be found in the cited references. A patent “composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.” KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 418 (2007). When an obviousness determination relies on the combination of two or more references, there must be some suggestion or motivation to combine the references. WMS Gaming Inc. v. Int'l Game Tech., 184 F.3d 1339, 1355 (Fed. Cir. 1999), (citing In re Rouffet, 149 F.3d at 1355.) “[V]irtually all [inventions] are combinations of old elements.’ . . . [R]ejecting patents solely by finding prior art corollaries for the claimed elements would permit an examiner to use the claimed invention itself as a blueprint for piecing together elements in the prior art to defeat the patentability of the claimed invention. Such an approach would be ‘an illogical and inappropriate process by which to determine patentability.’” In re Rouffet, 149 F.3d 1350, 1357 (Fed. Cir. 1998) (internal citations omitted). An obviousness determination requires identification of “a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.” KSR, 550 U.S. at 418. See also MPEP § 2143.01 (“A statement that modifications of the prior art to meet the claimed invention would have been ‘well within the ordinary skill of the art at the time the

claimed invention was made' because the references relied upon teach that all aspects of the claimed invention were individually known in the art is not sufficient to establish a *prima facie* case of obviousness without some objective reason to combine the teachings of the references.")

In choosing individual pieces of five different references, each disclosing an apparatus functioning in a significantly different manner, the Examiner is clearly using knowledge gleaned from the present disclosure as a roadmap to reconstruct the claims of the present application. This is an impermissible use of hindsight analysis which cannot form the basis of a valid rejection under 35 U.S.C. § 103. See Innogenetics, N.V. v. Abbott Labs., 512 F.3d 1363 (Fed. Cir. 2008) (citing Graham v. John Deere Co., 383 U.S. 1, 36 (1966)) (discussing "the importance of guarding against hindsight... and resist[ing] the temptation to read into the prior art the teachings of the invention in issue" when considering the obviousness of a patent); W.L. Gore & Associates, Inc. v. Garlock, Inc., 721 F.2d 1540, 1553 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984); Ex parte Gilham, No. 2009-000691 (BPAI Dec. 3, 2009) (reversing an Examiner's obviousness rejection for using impermissible hindsight and providing only a conclusory statement in support of why one of skill in the art would make an asserted combination of references); MPEP § 2141.01 III.

Further, in picking the individual pieces of the various references to combine to reconstruct the claims of the present application, the Examiner ignores the context of the references in which these pieces are found. For example, the Examiner asserts that "one would use the teachings of Smith for the backwashing steps in the teaching of Sunaoka because it is highly effective according to Smith" (Office Action at pages 6-7). In making this assertion, the Examiner ignores the fact that the systems of Smith and Sunaoka operate in incompatible ways. As set forth in the Response filed May 4, 2009, at pages 18-19, the system of Smith operates in a fundamentally different way from the system of Sunaoka; Smith uses a chemical cleaner passed through the membrane lumens to clean a biofilm from the membranes, whereas Sunaoka relies on aeration with an optional filtrate backwash to clean an accumulated layer of iron oxide from the membrane fibers. There is no reason why one of ordinary skill in the art would have expected a method of backwashing that is allegedly "highly effective" in the system of Smith to be useful in the apparatus of Sunaoka.

In another example, the Examiner asserts that "[i]t would be obvious to one of ordinary skill in the art to use the teachings of Kopp and/or Smith in the teaching of Cote to improve the

cleaning process of Cote, particularly, by removing the permeate in the lumen by gas pressure below the bubble point, as suggested by Kopp or Smith" (Office Action at page 6). The Examiner does not, however, articulate any reason why "removing permeate in the lumen by gas pressure below the bubble point" would improve the cleaning process of Cote. The Examiner impermissibly uses a conclusory statement, without any articulated reasoning, to provide the alleged rationale for the combination of these references. "[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." KSR, 550 U.S. at 417-418, quoting In re Kahn, 441 F.3d 977, 988 (CA Fed. 2006).

ii. Objective evidence provided in the Zha Declaration demonstrates that one of ordinary skill in the art would not have been motivated to have made the combinations of references asserted by the Examiner.

As stated in the Zha Declaration, one of ordinary skill in the art would have been dissuaded from combining Smith and/or Sunaoka and/or Kopp and/or Cote and/or JP '769 in the manner asserted by the Examiner. One skilled in the art would not have been motivated to have modified the methods of any of Smith, Sunaoka, Kopp, Cote, or JP '769 in view of any other of these references to result in a method as claimed in the present application. To do so would have yielded a method which produced results that one of ordinary skill in the art would have sought to avoid. These undesirable results include the generation of environmentally unfriendly gasses (Zha Declaration at paragraph 10), the generation of significant foaming in the filtration apparatus (*Id.*), a reduction in the operating efficiency of the apparatus disclosed (Zha Declaration at paragraphs 11 and 16), and/or an increase in capital cost of apparatus used to perform such a method, with no compensating benefit (Zha Declaration at paragraphs 17, 20, and 28).

One skilled in the art would not have been motivated to have modified Smith in view of any of Sunaoka, Kopp, Cote, or JP '769, to have modified Cote in view of any of Smith, Sunaoka, Kopp, or JP '769, or to have modified JP '769 in view of any of Smith, Sunaoka, Kopp, or Cote to result in a method as recited in claim 1 of the present application because this

would have rendered the apparatus disclosed in these references incapable of performing for their intended purposes. (Zha Declaration at paragraphs 12, 13, 23, 27.) See McGinley v. Franklin Sports, Inc., 262 F.3d 1339, 1354 (Fed. Cir. 2001) (“If references taken in combination would produce a ‘seemingly inoperative device,’ we have held that such references teach away from the combination and thus cannot serve as predicates for a *prima facie* case of obviousness.”); Tec Air, Inc. v. Denso Mfg. Mich. Inc., 192 F.3d 1353, 1360 (Fed. Cir. 1999) (citing In re Sponnoble, 405 F.2d 578, 587 (CCPA 1969)) (“If when combined, the references ‘would produce a seemingly inoperative device,’ then they teach away from their combination.”); In re Gordon, 733 F.2d 900, 902 (Fed. Cir. 1984) (finding no suggestion to modify a prior art device where the modification would render the device inoperable for its intended purpose).

One skilled in the art would not have been motivated to have modified Sunaoka in view of any of Smith, Kopp, Cote, or JP ‘769, to have modified Kopp in view of any of Smith, Sunaoka, Cote, or JP ‘769, to have modified Cote in view of any of Smith, Sunaoka, Kopp, or JP ‘769, or to have modified JP ‘769 in view of any of Smith, Sunaoka, Kopp, or Cote to result in a method as recited in claim 1 of the present application because to do so would have required a significant change to the structure and method of operation of the disclosed apparatus, which would only have increased the complexity and cost of said apparatus, while not providing a solution to any disclosed problem. (Zha Declaration at paragraphs 17, 20, 24, 28, 29, and 30.) MPEP § 2143.01 VI (“If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. In re Ratti, 270 F.2d 810, 123 USPQ 349 (CCPA 1959.”); Id. at 813 (Reversing an Examiner’s obviousness rejection because the “suggested combination of references would require a substantial reconstruction and redesign of the elements shown in [the primary reference] as well as a change in the basic principles under which the [primary reference] construction was designed to operate.”)

Accordingly, there can be no *prima facie* case of obviousness of independent claim 1 over the combination Smith and/or Sunaoka and/or Kopp and/or Cote and/or JP ‘769 because, as evidenced by the statements made in the Zha Declaration, one of ordinary skill in the art would not have been motivated to have combined these references in the manner asserted by the Examiner.

Dependent claims 24-28 each depend from independent claim 1, and there can be no *prima facie* case of obviousness of these claims over the asserted combination of Smith and/or Sunaoka and/or Kopp and/or Cote and/or JP '769 for at least the same reasons as independent claim 1.

Independent claims 4 and 10 and the claims that depend from these claims (dependent claims 5-9 and 11, respectively) were also rejected over the combination Smith and/or Sunaoka and/or Kopp and/or Cote and/or JP '769. As this combination is improper, there can be no *prima facie* case of obviousness of independent claims 4 and 10, or the claims that depend from these claims, either.

In the Office Action at pages 8-9, the Examiner dismisses the statements made in the Zha Declaration as "only his opinions." This constitutes clear error by the Examiner. The Examiner does not question Dr. Zha's qualifications as one of ordinary skill in the art of membrane filtration technology. Dr. Zha makes numerous statements of fact that he, as one of ordinary skill in the art, would not have been motivated to have made the combination of Smith and/or Sunaoka and/or Kopp and/or Cote and/or JP '769 asserted by the Examiner. See e.g., Zha Declaration at paragraph 9, "As one of ordinary skill in the art, at the time of invention of the present invention I would not have been motivated to have modified Smith in light of any of Sunaoka, Kopp, Cote, and JP 11076769 to perform each of the acts recited in independent claim 1 of the present application," at paragraph 15, "As one of ordinary skill in the art, I would not have been motivated to have modified Sunaoka in light of any of Smith, Kopp, Cote, and JP 11076769 to perform each of the acts recited in independent claim 1 of the present application," and at paragraphs 19, 22, and 26. It is clear error for the Examiner to simply dismiss the statements made in the Zha Declaration and substitute his own opinion of what one of ordinary skill in the art would have been motivated to do. In re Sullivan, 498 F.3d 1345, 1351 (Fed. Cir. 2007) (vacating a decision of the BPAI for failing to consider rebuttal evidence presented in expert declarations); In re Soni, 54 F.3d 746, 750 (Fed. Cir. 1995) (all evidence of nonobviousness must be considered when assessing patentability); In re Zeidler, 682 F.2d 961, 967 (CCPA 1982) (The Patent Office cannot substitute its own judgment for that of an established expert in the art); MPEP § 716.01 (Evidence traversing rejections, when timely presented, must be considered by the examiner whenever present.); Ex Parte Kabeya, No. 2007-

2421, (BPAI Sept. 20, 2007) (non-precedential) (reversing the rejections of the Examiner on appeal for failure to credit the declarations of two persons of skill in the relevant art.)

Further, even if the statements made in the Zha Declaration could be considered opinion rather than fact, the Examiner is still required to consider them and give them appropriate weight. “Although factual evidence is preferable to opinion testimony, such testimony is entitled to consideration and some weight so long as the opinion is not on the ultimate legal conclusion at issue. While an opinion as to a legal conclusion is not entitled to any weight, the underlying basis for the opinion may be persuasive. In re Chilowsky, 306 F.2d 908, 134 USPQ 515 (CCPA 1962) (expert opinion that an application meets the requirements of 35 U.S.C. 112 is not entitled to any weight; however, facts supporting a basis for deciding that the specification complies with 35 U.S.C. 112 are entitled to some weight); In re Lindell, 385 F.2d 453, 155 USPQ 521 (CCPA 1967) (Although an affiant’s or declarant’s opinion on the ultimate legal issue is not evidence in the case, ‘some weight ought to be given to a persuasively supported statement of one skilled in the art on what was not obvious to him.’ 385 F.2d at 456, 155 USPQ at 524 (emphasis in original)).” MPEP § 716.01(c).

The rejection of claims 1, 4-11, and 24-28 involves clear error because there is no suggestion to combine the teachings of Smith and/or Sunaoka and/or Kopp and/or Cote and/or JP ‘769, as asserted by the Examiner, apart from improperly using Applicant’s invention as a template for a hindsight reconstruction of Applicant’s claims. As evidenced by the Zha Declaration, upon reading any of the references cited by the Examiner, alone or in combination, one skilled in the art would not have been motivated to have modified the teachings disclosed therein to result in a method as claimed in any of the claims of the present application.

In conclusion, the Examiner has committed clear error in dismissing the Zha Declaration which establishes that there is no *prima facie* case of obviousness of any of the claims of the present application over the combination of Smith and/or Sunaoka and/or Kopp and/or Cote and/or JP ‘769.

2. Even if the asserted combination of references were valid, the combination still fails to teach each and every element of the present claims.

Even if the cited references could have been validly combined in the manner asserted by the Examiner, all elements of the claims of the present application still would not be found in the asserted combination of references. For example, the act recited in claim 1 of “isolating the lumens of the membranes, the manifold, the portion of the piping, and a gas inlet when the filtration process is stopped, the lumens of the membranes, the manifold, and the portion of piping upstream of the valve during filtration, wherein the lumens of the membranes, the manifold, and the portion of piping consist of those through which permeate is withdrawn while filtering the feed liquid” is not found in any of the cited references. In the Office Action at page 4, the Examiner asserts that “the specific details of the lines and manifolds to be included in the backwash is also not patentable – these are only details of implementing the process step in a specific system.” The isolating act recited in claim 1 is however, more than “only details of implementing the process step.” This act defines the portion of permeate that is used in the backwashing act of the claimed invention.

Further, the act recited in claim 1 of “venting the second gas from the isolated lumens, manifold, and portion of piping” is not found in any of the cited references. The Examiner asserts on page 7 of the Office Action that “[t]he additional step of venting the gases remaining in the lumen is also implied, since such gas remaining in the lumen will be vented out through the filtrate flow when normal filtration is resumed.” The Examiner does not, however, address venting of gas from the isolated manifold and portion of piping as recited in this act of claim 1.

As no *prima facie* case of obviousness has been established, all claims are patentable over the combination of Smith and/or Sunaoka and/or Kopp and/or Cote and/or JP ‘769 asserted by the Examiner.

3. Secondary indicia of non-obviousness illustrate that the claimed subject matter is non-obvious.

Even if a *prima facie* case of obviousness of any of claims 1, 4-11, and 24-28 were to have been established, this *prima facie* case would be overcome by secondary indicia of non-obviousness of the subject matter of these claims.

Evidence of commercial success of products operating in accordance with the claimed subject matter, provided in the Declaration of Bruce Biltoft, signed October, 22, 2009 (hereinafter the “Biltoft Declaration”), attached as an appendix to this Appeal Brief, demonstrate that the subject matter claimed in the present application cannot be obvious.

Affidavits or declarations, when timely presented, containing evidence of criticality or unexpected results, commercial success, long-felt but unsolved needs, failure of others, skepticism of experts, etc., must be considered by the examiner in determining the issue of obviousness of claims for patentability under 35 U.S.C. § 103. MPEP § 716.01(a) “Evidence rising out of the so-called ‘secondary considerations’ must always when present be considered en route to a determination of obviousness. . . Indeed, evidence of secondary considerations may often be the most probative and cogent evidence in the record.” Stratoflex, Inc. v. Aeroquip Corp., 713 F.2d 1530, 1538 (Fed. Cir. 1983). Objective evidence of nonobviousness may include commercial success, long-felt but unsolved need, and licenses showing industry respect. WMS Gaming, 184 F.3d at 1359 (citing In re Rouffet, 149 F.3d at 1355.) “In order to overcome a finding of obviousness by demonstrating commercial success, ‘[a] nexus between commercial success and the claimed features is required.’ ‘[T]he asserted commercial success of the product must be due to the merits of the claimed invention beyond what was readily available in the prior art.’” Therasense, Inc. v. Becton, Dickinson and Co., No. 2008-1511, -1512, -1513, -1514, -1595, slip op. at 15 (Fed. Cir. January 25, 2010) (internal citations omitted).

As set forth in the Biltoft Declaration, hollow fiber membrane filtration systems which operate in accordance with the methods recited in claims 1, 4-11, and 24-28 of the present application provide significant advantages over competing membrane filtration systems. These advantages have led to the commercial success of said systems. (Biltoft Declaration at paragraphs 4-9 and 12.) For example, “performing a method including [the acts recited in independent claims 1, 4, and 10 of the present application] permits the elimination of any

backwash pump and tank for holding the permeate for backwash of the system. This provides for a reduced capital cost as opposed to systems including a backwash pump and permeate holding tank. Elimination of the backwash pump and permeate holding tank reduces the capital cost from that of a typical membrane filtration system by approximately 5%.” (Biltoft Declaration at paragraph 5).

Further, systems operating in accordance with the claimed subject matter operate with backwash time “reduced by approximately 5%, resulting in an increased operating efficiency of approximately 1%” versus competing filtration systems. (Biltoft Declaration at paragraph 6).

Additionally, systems operating by “directing the portion of liquid permeate into the membrane module through a first end of the membrane module and through a second end of the membrane module to effect backwash,” as recited in independent claim 1 of the present application, produce significantly less backwash waste than competing filtration systems. To operate membrane filtration systems in accordance with these acts as recited in independent claim 1 of the present application “provides for reducing the amount of liquid backwash waste when compared to systems where permeate for backwashing is supplied from a permeate tank. This allows the systems operating in accordance with the methods claimed in the present application to operate in an environmentally-friendly manner. This also allows [such] systems . . . to operate at a lower cost than competing systems which generate more backwash waste which is typically further treated or disposed of at additional cost. Backwash waste is typically 20% less.” (Biltoft Declaration at paragraph 7).

These advantages with regard to reduced capital and operating costs, increased operating efficiency, and reduced waste have been touted by salespersons and marketing teams when promoting systems operating in accordance with the claimed methods. (Biltoft Declaration at paragraph 11). These advantages have increased customer demand for systems operating in accordance with the method recited in independent claim 1 of the present application. (Biltoft Declaration at paragraph 12). This has resulted in a market share for systems operating in accordance with the method recited in claim 1 of the present application to have reached approximately 25% since their introduction in 2005. (Biltoft Declaration at paragraphs 10 and 13). There has been an increase of 500% in sales of systems operating in accordance with the method recited in claim 1 of the present application in the four years following the year of their introduction. (Biltoft Declaration at paragraphs 14 and 15). Systems operating in accordance

with the method recited in claim 1 of the present application now account for 50% of all sales for hollow membrane filtration systems sold by Siemens Water Technologies Corp. (the assignee of the present application.) (Biltoft Declaration at paragraph 16).

In the Office Action at page 8, the Examiner dismisses the improvements to membrane filtration systems set forth in the Biltoft Declaration as resulting from operating in accordance with the claimed method as “marginal” and asserts that “the Declarant has failed to link the commercial success of these systems to the claimed invention.” This constitutes clear error by the Examiner. The Biltoft Declaration clearly established nexus between the claims of the present application and the commercial success of systems operating in accordance with the methods claimed. For example, as stated in the Biltoft Declaration at paragraph 12 “The advantages described [with regard to reduced capital and operating costs, increased operating efficiency, and reduced waste] have produced increased customer demand for products performing according to the method recited in claim 1 of the present application, resulting in the commercial success of these products.” Further, the commercial success and sales growth of systems operating in accordance with the methods claimed in the current application (Biltoft Declaration at paragraphs 13-16) show that such methods could not have been obvious at the time of their invention.

Any one of the above referenced advantages with regard to reduced capital and operating costs, increased operating efficiency, and reduced waste, constitutes a significant improvement for the wastewater treatment industry. For any two of the above referenced advantages to be provided in a single apparatus or method would constitute a leap forward for the wastewater treatment industry. For any three of the above referenced advantages to be provided by a single invention would constitute a once in a generation improvement for the wastewater treatment industry. The presently claimed invention provides for all of these above referenced advantages, and as evidenced by the significant increase in sales of products incorporating the claimed invention, has provided the wastewater treatment industry with a game changing new technology.

The Biltoft Declaration thus provides strong evidence linking the subject matter claimed in the current application to the commercial success of membrane filtration systems operating in accordance with the claimed methods. This evidence of commercial success linked to the claimed subject matter is a strong secondary indication of non-obviousness which would

overcome any *prima facie* case of obviousness of said claimed subject matter, should such a *prima facie* case have been established.

B. Summary

As made clear in the Biltoft Declaration, the presently claimed invention provides for once in a generation advances that have provided for wastewater treatment solutions that are less costly, less wasteful, and more energy efficient. These advances have resulted in wastewater treatment solutions that are more accessible, cleaner, and more environmentally sound than previously known solutions. Given the once in a generation set of advantages provided by the presently claimed invention, if, as asserted by the Examiner, it was obvious at the time of conception by the inventors, it would have already been made available. In asserting that the presently claimed invention was obvious, the Examiner is suggesting that this once in a generation advance in the wastewater treatment industry was obvious, yet, for some reason, was not undertaken for the benefit of society.

To make his case, the Examiner uses a combination of not two, or even three, but five separate references, and improperly selectively chooses portions of each, out of context, using the present claims as a roadmap to reconstruct the claimed invention; all this, and the Examiner still fails to find all elements of the recited claims in the cited references and fails to show any valid motivation why one of ordinary skill in the art would have made the asserted combinations.

In view of the above, each of the rejections is improper and should be reversed.
Appellant respectfully requests reversal of the rejections and issuance of a Notice of Allowance.

VIII. CLAIMS APPENDIX (37 C.F.R. § 41.37(c)(1)(viii))

1. (Previously Presented) A method of backwashing a membrane filtration system including a vessel, a membrane module, piping, and a manifold comprising:

filtering a feed liquid through pores in walls of membranes of the membrane filtration system to produce a liquid permeate;

withdrawing the permeate from lumens of the membranes and through the manifold, a portion of the piping, and a valve while filtering the feed liquid;

stopping the filtration process;

isolating the lumens of the membranes, the manifold, the portion of the piping, and a gas inlet when the filtration process is stopped, the lumens of the membranes, the manifold, and the portion of piping upstream of the valve during filtration, wherein the lumens of the membranes, the manifold, and the portion of piping consist of those through which permeate is withdrawn while filtering the feed liquid;

scouring surfaces of the membranes by flowing bubbles of a first gas past surfaces of the membranes;

supplying a second gas through a second gas inlet at a pressure less than a bubble point of the membranes;

applying the second gas to a portion of liquid permeate present in the isolated lumens, manifold, and portion of piping by introducing the second gas through the second gas inlet into the filtration system on a side of the valve in direct fluid communication with the membrane module;

directing the portion of liquid permeate into the membrane module through a first end of the membrane module and through a second end of the membrane module;

backwashing the membranes by displacing at least some of the portion of liquid permeate through pores in walls of the membranes, the second gas not penetrating into the membrane pores;

discharging backwash waste from the vessel;

refilling the vessel with feed liquid;

venting the second gas from the isolated lumens, manifold, and portion of piping; and resuming filtration.

2-3. (Canceled)

4. (Previously Presented) A method of filtering solids from a liquid suspension comprising:

- immersing filtration membranes in the liquid suspension;
- filtering the liquid suspension through pores in walls of the filtration membranes;
- producing a liquid permeate within lumens of the filtration membranes;
- drawing off liquid permeate from the lumens;
- withdrawing the permeate from the lumens and through a manifold and a valve;
- periodically suspending the filtration process;
- isolating the lumens, the manifold, a gas inlet, and a portion of piping when the filtration process is suspended, the lumens, the manifold, and the portion of piping upstream of the valve during filtration, wherein the lumens, the manifold, and the portion of piping consist of those through which permeate is withdrawn;
- directing liquid permeate present in the isolated manifold and portion of piping into the lumens through a first end of the filtration membranes and through a second end of the filtration membranes; and
- applying a gas at a pressure below a bubble point of the filtration membranes to the liquid permeate to displace at least some of the liquid permeate through the pores in the walls of the filtration membranes in a direction opposite to that of filtration, the gas not penetrating into the membrane pores.

5. (Previously Presented) The method of filtering solids from a liquid suspension according to claim 4 wherein displacing at least some of the liquid permeate through the pores in the walls of the filtration membranes comprises removing solids from the filtration membranes into the liquid suspension surrounding the filtration membranes.

6. (Previously Presented) The method of filtering solids from a liquid suspension according to claim 5 further comprising reducing the volume of the liquid suspension surrounding the filtration membranes before displacing at least some of the liquid permeate through the pores in the walls of the filtration membranes.

7. (Previously Presented) The method of filtering solids from a liquid suspension according to claim 6 wherein the volume of liquid suspension surrounding the filtration membranes is reduced by suspending provision of the liquid suspension while providing a pressure differential across walls of the filtration membranes and drawing permeate from the filtration membranes.
8. (Previously Presented) The method of filtering solids from a liquid suspension according to claim 5 further comprising removing at least part of the liquid suspension surrounding the filtration membranes containing the removed solids by a sweep, drain-down or by a feed and bleed process to at least partially discharge the liquid suspension surrounding the filtration membranes.
9. (Previously Presented) The method of filtering solids from a liquid suspension according to claim 4 further comprising using permeate remaining in ancillaries such as headers, and piping in addition to that in the filtration membrane lumens and manifold as a source of backwash liquid.
10. (Previously Presented) A method of filtering solids from a liquid suspension comprising:
 - applying the liquid suspension to lumens of filtration membranes;
 - filtering the liquid suspension through pores in walls of the filtration membranes;
 - forming liquid permeate on a shell side of a pressure vessel in which the filtration membranes are mounted;
 - drawing off liquid permeate from the shell side of the pressure vessel;
 - periodically suspending the filtration process; and
 - applying a gas at a pressure below a bubble point of the filtration membranes to liquid permeate remaining within the shell side of the pressure vessel, the liquid permeate remaining within the shell side of the pressure vessel consisting of the liquid permeate formed on the shell side of the pressure vessel, to displace at least some of the liquid permeate through the filtration membrane pores in a direction opposite to that of filtration, the gas not penetrating into the membrane pores.

11. (Previously Presented) The method of filtering solids from a liquid suspension according to claim 4 further comprising increasing the amount of permeate available for backwashing when filtration is suspended by providing a further chamber or reservoir in a permeate flow circuit.

12. (Canceled)

13. (Withdrawn) A filtration system for removing fine solids from a liquid suspension comprising:

- (i) a vessel for containing said liquid suspension;
- (ii) a plurality of permeable, hollow membranes within the vessel;
- (iii) means for providing a pressure differential across walls of said membranes such that some of the liquid suspension passes through the walls of the membranes to be drawn off as permeate;
- (iv) means for withdrawing permeate from the membranes; and
- (v) means for applying gas at a pressure below the bubble point to the liquid permeate within the system and the membrane lumens to affect a discharge of at least some of the liquid permeate in the lumens through the membrane walls to dislodge any solids retained therein and displace the removed solids into the liquid suspension surrounding the membranes.

14. (Withdrawn) A filtration system according to claim 13 wherein said membranes are mounted in a number of membrane modules and the membrane modules are used in a bank and connected to a manifold for distributing liquid suspension to and removing permeate from the system.

15. (Withdrawn) A filtration system according to claim 14 wherein the gas is introduced into the manifold of the bank of modules so that permeate within the manifold is utilized for backwash.

16. (Withdrawn) A filtration system according to claim 13 further including means to reduce the volume of liquid suspension in the vessel before the backwash so as to reduce the backwash waste volume.

17. (Withdrawn) A filtration system according to claim 16 wherein the volume of liquid suspension in the vessel is reduced by suspending flow of feed to the feed vessel while continuing to provide a pressure differential across walls of said membranes and withdrawal of permeate from the membranes.

18. (Withdrawn) A filtration system according to claim 17 wherein the pressure differential across walls of said membranes is obtained by application of a pressurized gas.

19-23. (Canceled)

24. (Previously Presented) The method according to claim 1, wherein the permeate remaining present in the system when the filtration process is stopped consists of permeate present in the system on a side of a valve configured and arranged to isolate the filtration membranes from a second section of piping.

25. (Previously Presented) The method according to claim 1, wherein isolating the membrane lumens, the manifold, and the gas inlet comprises closing the valve, the valve configured and arranged to isolate the membranes from a second section of piping.

26. (Previously Presented) The method according to claim 1, wherein backwashing is performed without the use of a backwash pump or a permeate holding tank.

27. (Previously Presented) The method according to claim 1, wherein the permeate remaining present in the system when the filtration process is stopped consists of at least one of permeate remaining in at least one manifold in fluid communication with at least one membrane module, in at least one membrane module header, in piping associated with the at least one manifold and the at least one membrane module header, and in a permeate side of filtration membranes

28. (Previously Presented) The method according to claim 1, further comprising draining down liquid suspension including the displaced backwashing liquid.

U.S. Serial No. 10/572,893

- 22 -

Art Unit: 1797

29. (Canceled)

IX. EVIDENCE APPENDIX (37 C.F.R. § 41.37(c)(1)(ix))

- A. Declaration of Dr. Fufang Zha, filed under 37 CFR § 1.132 on November 12, 2009.
- B. Declaration of Bruce Biltoft, filed under 37 CFR § 1.132 on November 12, 2009.

X. **RELATED PROCEEDINGS APPENDIX (37 C.F.R. § 41.37(c)(1)(x))**

None.

XI. CONCLUSION

For the reasons provided above, the rejections are improper and should be reversed. Appellant respectfully requests reversal of the rejections and issuance of a Notice of Allowance.

If there is any additional fee occasioned by this filing, including an extension fee that is not covered by an accompanying payment, please charge any deficiency to Deposit Account No. 50/2762, Ref. No. M2019-7033US.

Respectfully submitted,
Fufang Zha et al., Appellant

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